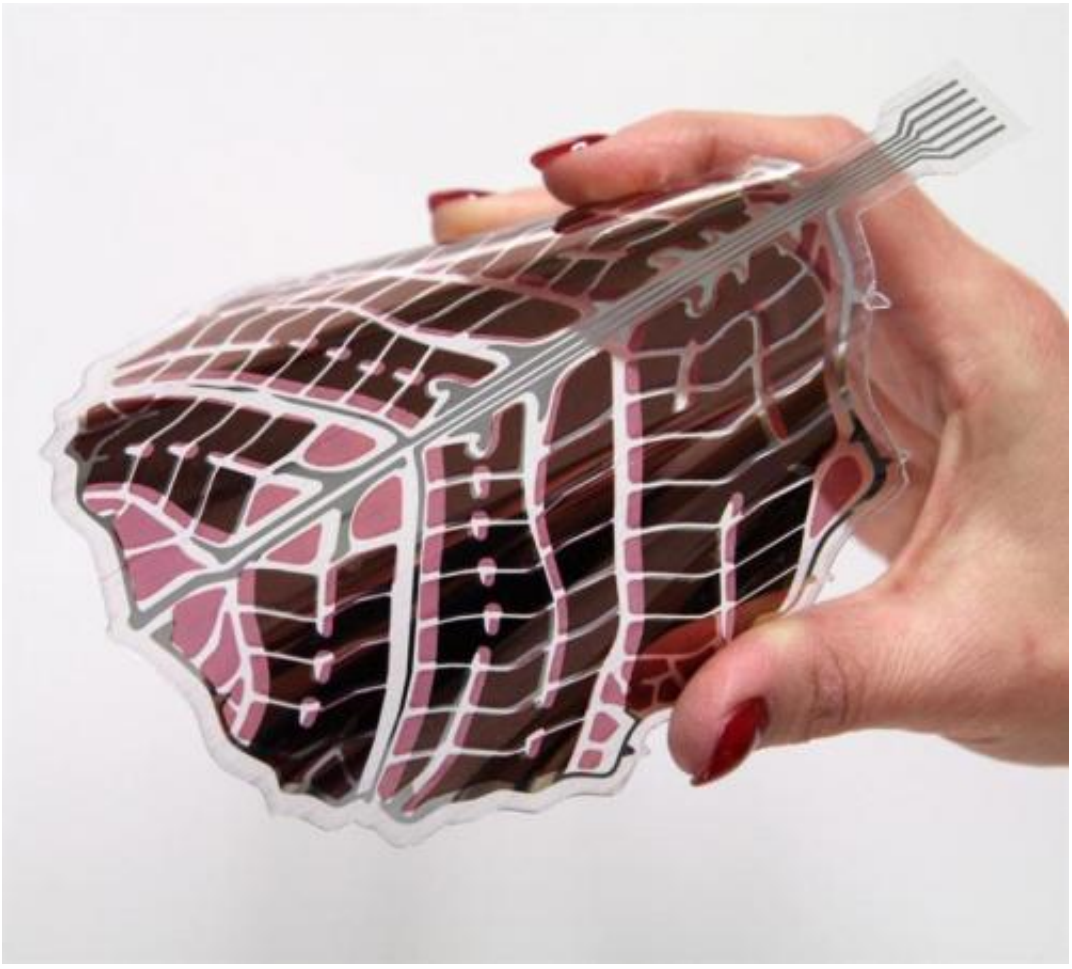
Decorative and flexible solar panels become part of interior design and the appearance of objects

January 21 2015



VTT has developed a mass production method allowing the manufacturing of decorative, organic solar panels. Active surface of a one leaf is 0..0144 m2 and includes connections and a decorative part. Graphics can be printed to improve the visual appearance. Credit: Antti Veijola.

VTT Technical Centre of Finland has developed and utilized a mass production method based on printing technologies allowing the manufacturing of decorative, organic solar panels. Design freedom improves the range of applications of the panels on the surfaces of interior and exterior building spaces. VTT is also studying the feasibility of printing technology in the mass production of solar panels made from inorganic perovskite materials.

The new mass production method enables to create interior design elements from organic solar panels (OPV, organic photovoltaics) harvesting energy from interior lighting or sunlight for various small devices and sensors that gather information from the environment. The panels can, for example, be placed on windows and walls and on machines, devices and advertisement billboards. Until now, it has only been possible to pattern OPV panels into a form of stripes.

The solar panel manufactured with VTT's gravure and screen printing technologies is only around 0.2 mm thick, and includes the electrodes and polymer layers where the light is collected. Furthermore, graphics can be printed to improve its visual appearance.

VTT has proven the feasibility of the method in its own pilot manufacturing unit, using commercially available materials. VTT is commercialising this manufacturing technology with different operators, and is actively seeking new final-stage appliers of the technology.

The research scientists have tested the feasibility of the method by printing leaf-shaped photovoltaic cells. Active surface of a one leaf is 0.0144 m2and includes connections and a decorative part. Two hundred OPV leaves make one square metre of active solar panel surface that generates 3.2 amperes of electricity with 10.4 watts of power at

Mediterranean latitudes.

Flexible OPV cells

Organic solar panels are flexible and light, but their efficiency is lower compared to conventional, rigid silicon-based solar panels. The solar panels are manufactured with printing machines based on conventional printing methods using the roll-to-roll method, which enables the rapid mass production of the products: the printing machine can produce up to 100 metres of layered film per minute. The manufacturing of the OPV cells is affordable; the material consumption is low, and after use, the OPV panels can be recycled..

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The market for organic photovoltaic cells is developing, with a market breakthrough expected within three years. The operating life of panel is few years which is enough for many applications.

VTT is developing roll-to-roll manufacturing methods for inorganic perovskite solar panels

VTT is also currently examining how well the roll-to-roll printing methods are suited to the manufacturing of inorganic solar panels made from perovskite materials. The first perovskite solar cells manufactured in the laboratory using solution-based processes have been promising. The performance of this solar cell is roughly five times better than that of an organic photovoltaic cell, and the material costs can be even ten times lower.

Freely designed decorative organic solar panels are applicable also in indoor use to harvest energy from indoor light. Production methods are cost-effective and materials can be recycled after the use. New materials such as perovskite can be printed with same methods and increase efficiency in future.

Using energy of light in data transfer

VTT is also developing a method to utilize light in wireless data transfer by using solar cells as data receivers. This will open new application possibilities to utilize printable solar cells e.g. in IoT (Internet of Things) type applications, in which the devices can also harvest energy from the ambient light. The first results have been very promising.

Provided by VTT Technical Research Centre of Finland